A Comparative Study on Foraging Behavior of the Jungle Babbler (*Turdoides striata*) and the Large Grey Babbler (*Argya malcolmi*)

A

Synopsis

Submitted in the partial fulfillment for the requirement of

Doctor of Philosophy

In

Zoology

Submitted by

Ankita Chauhan

Under the supervision of

Dr. Reshma Bhatnagar

Department of Zoology

Faculty of Science

DEPARTMENT OF ZOOLOGY, FACULTY OF SCIENCE

DAYALBAGH EDUCATIONAL INSTITUTE (DEEMED UNIVERSITY)

DAYALBAGH, AGRA-282005

2021

1. INTRODUCTION

The true perching birds called passerines with 4 toes (3 directed forward and 1 directed backward) belong to Passeriformes, which is the largest order of birds. It includes the babblers, which are a diverse group of oscine passerine birds, displaying great variation in body size (6-156g), bill shape, plumage colour, vocalization, social behavior and ecology (del Hoyo *et al.*, 2007; Cai *et al*, 2018). A total of 452 species have been reported, belonging to 5 families (Gill and Donsker, 2018).

Among these, family Leiotrichidae represents the largest clade of babblers in terms of species diversity with 125 species (Cibois *et al*., 2018). The members of this clade are distributed throughout Africa, most of southern Asia and the Great Sunda region. The Leiotrichidae are most diverse in the Sino-Himalayan and south-east Asian regions. The family contains species defined as laughing thrushes for their loud calls used when in large social groups, belonging to genera *Grammatoptila*, *Garrulax* and *Trochalopteran* and drab chattering savannah species in the genera *Turdoides* and *Argya* (Cibois *et al.,* 2018).

Seven species of babblers have been reported in India; *Turdoides striata, Argya malcolmi, Argya earlei, Argya caudatus, Turdoides affinis, Argya subrufa , Chatarrahaea longirostris.* The first 4 species are found in Agra but in the pilot studies conducted during the past six months only two of these species were spotted in abundance:

- *Turdoides striata* (Jungle Babbler)
- *Argya malcolmi* (Large Grey Babbler)

Foraging Behavior

Foraging is an essential activity in a bird's life which is indispensable for their survival but the demands of food acquisition impose significant challenges to both the physiology and behavior of birds (Anthal & Sahi, 2013). For birds to make foraging decisions, they must be capable of evaluating the profitability of food/prey items, the probability of capture using a tactic and the amount of time required to capture the food item/prey. The foraging behavior involves five basic sequential components - search, attack, foraging site, food and food handling. Social foraging strategies and their associations with learning and innovation abilities have been studied extensively in flocking birds , but their importance for cooperatively breeding birds has remained relatively unexplored (Keynan *et al*.,

2015). Closely related species share recent phylogenetic history and are relatively similar in morphology, behavior and physiology. Thus such species most likely employ different foraging strategies to reduce competition (Peterson *et al*., 1999). No two species or groups of species forage in exactly the same way and no two habitats present exactly the same foraging opportunities. Data on attack methods are primarily useful for studies of eco-morphology but may also be important in bioenergetics and community level studies. The system for measuring and classifying foraging behavior of non-raptorial land birds has been given by Remsen and Robinson (1990). It has standardized data gathering methods as well as the terminology to permit among-site and among-species comparisons.

1.1 Jungle Babbler, *Turdoides striata* (Dumont, 1823)

Field identification characteristics - yellow bill, creamy white eyes, yellow legs, long tail appears as if inserted into body , sexual dimorphism not identifiable (Gaston, 1978).

Plate 1: Jungle Babbler

1.1.1 Systematic position

Kingdom- Animalia

Phylum- Chordata

Class- Aves

Order- Passeriformes

Family- Leiotrichidae

Genus- *Turdoides*

Species- *striata*

1.1.2 Habitat and ecology

Jungle Babblers inhabit savannahs, deciduous forests, cultivation areas, shrub lands, artificial as well as terrestrial habitats (Ali and Ripley, 1995). Generation length is 8.8 years (IUCNredlist.org , 2016). They live in small, discrete, omnivorous flocks occupying a common territory in which they are resident throughout the year. Foraging is mainly on the ground among leaf litter, although the boles and large branches of trees are also used. Being poor at flying, Jungle Babblers rarely move more than a few meters from cover (Gaston, 1978). They are social/cooperative breeders as single breeding pair is assisted by the helpers who themselves forego their own breeding (allo-parental behavior). They act as natural bio-control agent and are very beneficial to agro-ecosystem (Bharucha and Padate, 2010)

1.1.3 Geographical range

Native: Bangladesh, Bhutan, India, Nepal, Pakistan

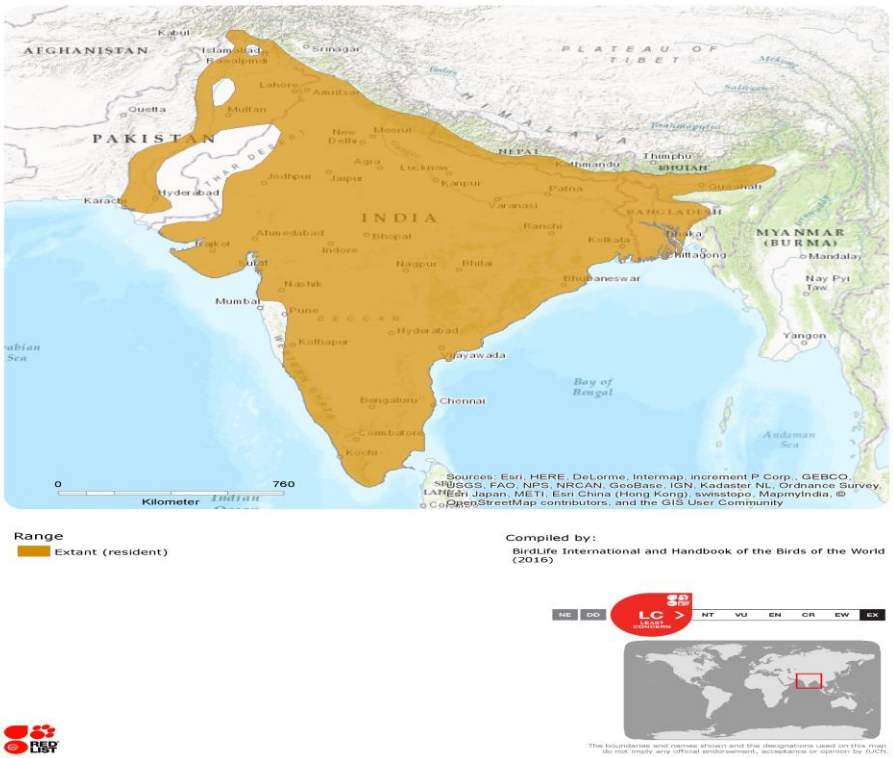

Figure 1: Map showing geographical distribution of Jungle Babbler (Source- IUCNredlist.org)

1.1.4 IUCN status

Jungle Babbler - Least Concern. The population status has not been quantified, but it is not believed

to approach the threshold for Vulnerable under the population size criterion (>30% decline over 10 years or 3 generations) (IUCNredlist.org, 2016).

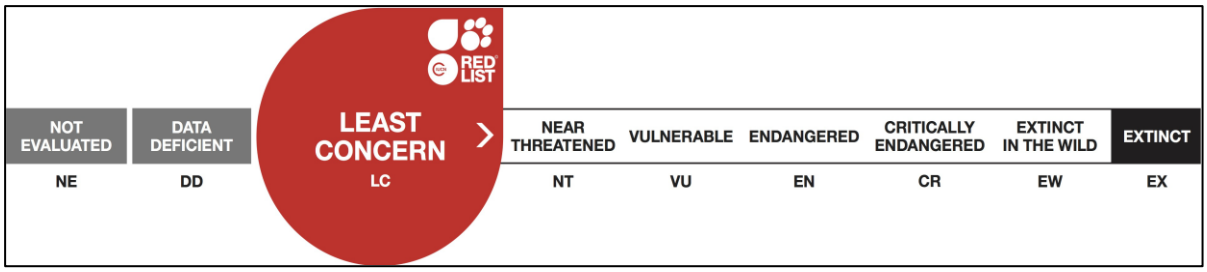

Figure 2: Conservation status of Jungle Babbler (IUCNredlist.org, 2016)

1.2 Large Grey Babbler, *Argya malcolmi* (Sykes, 1832)

Field identification characteristics- horny brown bill, bright yellow eyes, brownish grey legs, a long graduated tail with faint cross bars, sexual dimorphism is unidentifiable(Ali and Ripley, 1995).

Plate 2: Large Grey Babbler

1.2.1 Systematic position

Kingdom-Animalia

Phylum-Chordata

Class-Aves

Order-Passeriformes

Family- Leiotrichidae

Genus-*Argya*

Species-*malcolmi*

1.2.2 Habitat and Ecology

They inhabit forests, shrublands, artificial and terrestrial land, low vegetation, gardens, orchards (Toor and Saini, 1986). Generation length is 8.8 years (IUCNredlist.org, 2016). They forage in small flocks and are omnivores feeding on insect and plant matter in the low grass. They are natural bio-control agents as the adult babblers feed on insects, arachnids, wheat , maize, rice, weed seeds, leafy material and insect pests of stored grains, cucurbits and many plants (Toor and Saini,1986)

1.2.3 Geographic Range

Native: India, Nepal, Pakistan

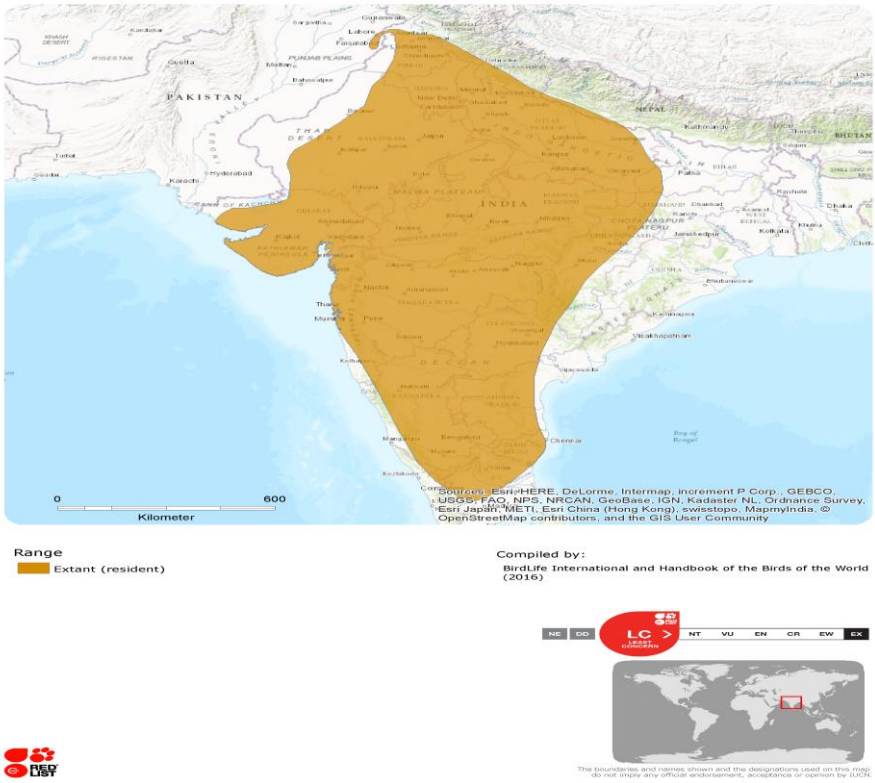

Figure 3: Showing the geographical distribution of Large Grey Babbler (IUCNredlist.org)

1.2.4 IUCN status

Large Grey Babbler - Least Concern. The population trend appears to be stable, and hence the species does not approach the threshold for Vulnerable under the population trend criterion (>30% decline over ten years or three generations) (IUCNredlist.org, 2016)

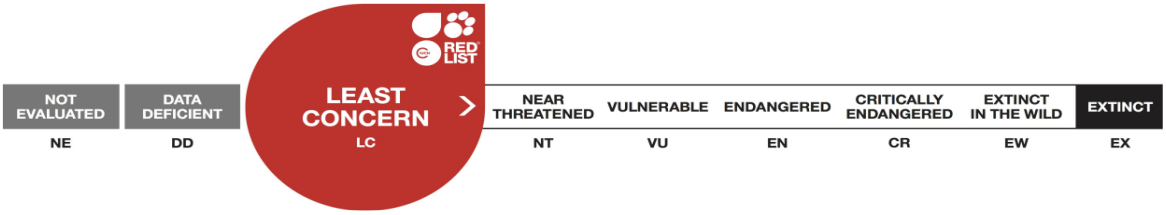

Figure 4: Conservation status of Large Grey Babbler (IUCNredlist.org, 2016)

2. REVIEW OF LITERATURE

2.1 International status

There is no report of behavioral study done on these two species outside India; however on various other babbler species a good amount of work has been done. Some of the significant papers studied are as follows:

- **Sorato *et al.* (2012)** studied the effects of predation risk on foraging behavior and group size in the Chestnut-crowned Babblers and concluded that predation is an important factor for selecting sociality.
- **Keynan (2014)** studied social foraging strategies and the acquisition of a novel foraging skill in 16 groups of wild, cooperatively breeding Arabian babbler and found that they differ in their foraging strategies and learning abilities according to their rank and that subordinate group members may be more opportunistic and flexible in their behavior than dominants as they use of both scrounging and novel foraging opportunities.
- **Styring *et al.* (2016)** studied foraging ecology and occurrence of seven sympatric babbler species, by (i) examining their key foraging preferences and potentially important microhabitat (ii) estimating abundances of each species in large tracts of native forest fragments and in plantation habitats.
- **Mansor and Ramli (2017)** studied foraging niche selection in Malaysian babblers and found that foraging height and substrate are two components which allow co-existence of sympatric babblers, suggesting that niche separation occurs among co-existing birds.

2.2 National status

- **Gaston (1977)** studied and analyzed 5 aspects of social behavior- allopreening, sentinel, leadership, play and roosting in relation to the age, sex and breeding status of different group members of the Jungle Babbler in New Delhi.
- **Gaston (1978)** gave an account of demography of the Jungle Babbler.
- **Gaston *et al.* (1978)** observed the regional variations in the breeding seasons by availability of nests of 4 species of babblers- Jungle Babblers, Large Grey Babbler, common babblers and white

headed babbler in Delhi and Calicut.

- **Toor and Saini (1986)** described the feeding ecology of Large Grey Babbler by observing feeding behavior, feeding associations and analyzing the gut contents of adults and nestlings in Ludhiana (Punjab). The birds fed on leaves of *shisham, 'beri'* and mulberry and were seen capturing ants and other insects from tree branches by swift movements of head. From Aug-Oct they were seen peeling off maize cobs and feeding. In winter they consumed large quantities of plant matter like fallen rice and wheat, from crop fields. In monsoon season they were found devouring termites which were often caught by them in mid-air by taking swift take-off like black drongo. Feeding associates of babblers at ground and nearby bushes were common myna, pied myna, hoopoe and Indian robin; at orchards and gardens - crow pheasant, hoopoe, pied crested cuckoo; at tree branches were red vented bulbul, rufous backed shrike, common myna and golden backed woodpecker; in paddy and wheat fields the babblers fed near house sparrows and weaver birds. The diet of adults constituted of 62 % of animal matter while the diet of young contained 93% of animal matter. They concluded that the major constituents of diet of these babblers are pests of stored grains, cucurbits and snails which are vectors of infectious diseases of livestock.
- **Bharucha and Padate (2010)** assessed the role of Jungle Babbler which predates on gram pod borer *Helicoverpa armigara* infesting the pigeon pea crop and reported that it acts as bio-control agent and feeds on the larvae of the insect. They also assessed the number of Jungle Babblers visiting the crops of maize, cowpea, sorghum and when there were no crops in the field i.e., on ploughed and unploughed fields. They concluded that the most preferable feeding site was ploughed fields and least preferred crop was sorghum.
- **Srivastava (2013)** observed the breeding behavior and nesting of Jungle Babbler in a house courtyard in Bikaner, Rajasthan.
- **Anthal and Sahi (2013)** studied the food and feeding ecology of Jungle Babbler, in district Jammu and Kashmir. They reported the foraging methods employed under different categories: i) hopping and gliding (closer to the ground to catch grasshoppers and crickets), (ii) lifting of leaves (flicking of leaves to reveal prey beneath them), (iii) probing (inserting beaks in curled leaves, bark and holes), (iv) peering (twisting of head to one side in search for caterpillars under the leaves), (v)

stationary plucking (hovering over fruit and berries). They were seen to move from one part of home range to another for optimization during foraging as well as patrolling of territory. They consumed plant food like fig, wild berry and fruit of mulberry. Grains were consumed but never from the standing crops. Intra-group aggression was rarely seen but at artificial feeding site, where food was concentrated, inter- as well as intra-group aggression was seen. The Jungle Babblers are regarded as the nuclear species of their respective foraging area. Other species gained benefit by vigilance of Jungle Babbler and joined them in mobbing the predator. A communal relationship between babblers and their feeding associates was reported.

- **Gupta (2014)** assessed the group size in Jungle Babblers and found the modal value to be 5 in Pune, Maharashtra.
- **Gupta and Talukdar (2018)** assessed the distribution of Jungle Babblers in India with the help of participation of professional and amateur ornithologists through web-based survey and later visited the sites of documentation of the bird.
- **Cibois *et al.* (2018)** gave a comprehensive phylogeny for laughing thrushes and allies (Aves: Leiotrichidae) and a proposal for a revised taxonomy.
- **Yambem *et al.* (2020)** studied the structural and functional complexity of vocalization in Jungle Babblers and categorized the calls produced by the signalers in variety of behavioral context-affiliative and agonistic and reported that the birds were employed towards coordination of diverse social behaviors including group movement, foraging, brood-care, aggression and vigilance.

2.3 Need of the study

Review of literature reveals that there is a discrepancy in the group size reported for Jungle Babblers. There is a maiden study done way back in 1986 on the behavior of Large Grey Babblers. No single detailed study has been reported to cover all the aspects of foraging behavior like communication, vigilance, intra-specific and inter-specific interactions and locomotion while foraging in both the species. Detailed analysis of foraging behavior of the species will prove to be helpful for the welfare of babblers, the ecosystem, the environment, the academicians, the farmers and the nation at large. This is an opportunity the researcher would like to take up and contribute to the knowledge base for better management of ecosystem and the repertoire of avian foraging behavior.

3. OBJECTIVES

1. To study the foraging behavior of *T. striata* and *A. malcolmi*.
2. To identify the factors affecting the foraging behavior of *T. striata* and *A. malcolmi*.
3. To compare the intra-specific and inter-specific interactions of *T. striata* and *A. malcolmi* during foraging behavior.
4. To analyze the impact of foraging behavior of *T. striata* and *A. malcolmi* on the agro-ecosystem.

4. HYPOTHESES

Null hypothesis (H_{01}) - There is no significant difference in the foraging behavior of *T. striata* and *A. malcolmi*.

Alternate hypothesis (H_{A1}) - There is a significant difference in the foraging behavior of *T. striata* and *A. malcolmi*.

Null hypothesis (H_{02}) - There is no significant difference in the intra-specific and inter-specific interactions of *T. striata* and *A. malcolmi* during foraging behavior.

Alternate hypothesis (H_{A2}) - There is a significant difference in the intra-specific and inter-specific interactions of *T. striata* and *A. malcolmi* during foraging behavior.

Null hypothesis (H_{03}) - There is no significant impact of foraging behavior of *T. striata* and *A. malcolmi* on the agro-ecosystem.

Alternate hypothesis (H_{A3}) - There is a significant impact of foraging behavior of *T. striata* and *A. malcolmi* on the agro-ecosystem.

The hypotheses testing will be done with suitable statistical tests at 5% level of significance. If the calculated value will be greater than the table value at 5% level of significance, the null hypotheses will be rejected and the alternate hypotheses will be accepted and vice-versa.

5. METHODOLOGY

The study will be non-invasive and purely observational, hence no ethical approval is required.

5.1 Scope and Sampling sites

The study will be restricted to Agra because an adequate sample size of both species is available in two types of habitats:

A. Agro-ecosystem 1. **Dayalbagh : 27.2220˚ N, 78.0028˚ E** (Figure-5)

2. **Khandauli : 27.3114˚N, 78.0292˚ E** (Figure-6)

B. Natural ecosystem 3. **Shahjahan Gardens : 27.1748˚ N, 78.0252˚E** (Figure-7)

4. **Taj Nature Walk : 27.17389˚N, 78.04206˚E** (Figure-8)

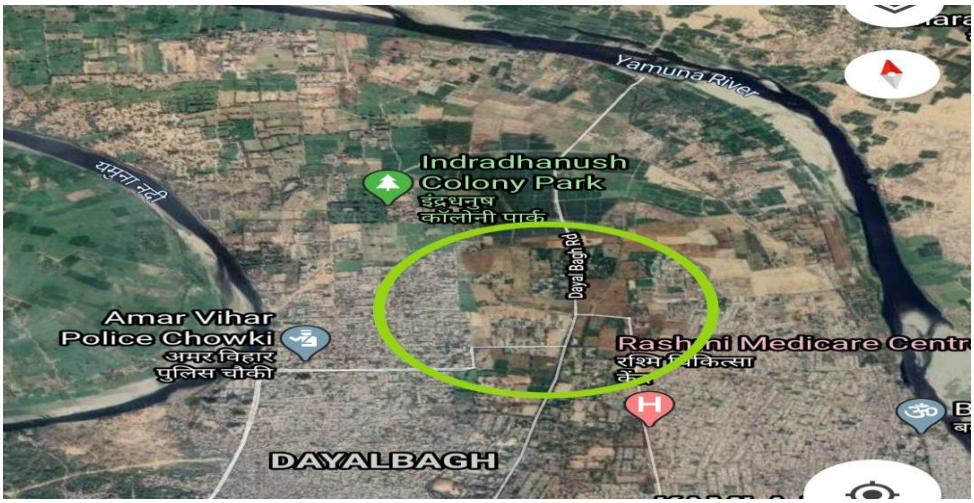

Figure 5: Sampling Site 1. Dayalbagh (courtesy-www.google.com)

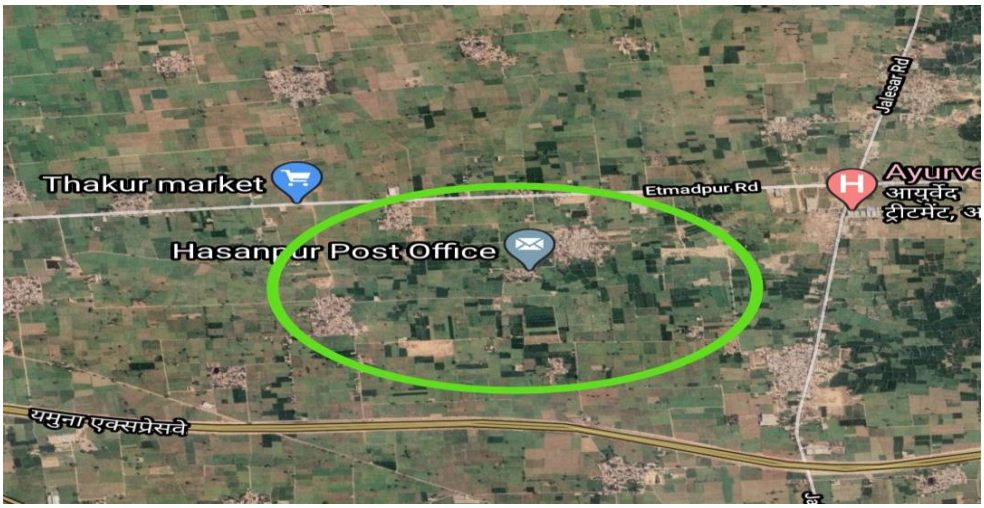

Figure 6: Sampling Site 2. Khandauli (courtesy-www.google.com)

Figure 7: Sampling Site 3. Shahjahan Gardens (courtesy-www.google.com)

Figure 8: Sampling Site 4. Taj Nature Walk (courtesy-www.google.com)

5.2 Sampling methods

Jungle Babblers and Large Grey Babblers are free ranging birds. They can be easily spotted in flocks but since they all look alike, individual identification is not possible. Therefore, broadly Probability Sampling method will be employed. Convenience Sampling and Interval Sampling will be applied as the study is intended to be longitudinal in nature.

5.3 Sampling techniques

Empirical/Primary Data Collection

- Scan sampling technique (Altmann, 1974)
- Focal sampling techniques (Martin and Bateson, 1993)
- *Ad-libitum* sampling technique (Altmann, 1974)
- System for measuring and classifying foraging behavior of terrestrial birds (Remsen and Robinson, 1990)
- GPS tracking of target species
- Still photography and videography
- Quadrat sampling for estimating pest population
- Interviews with farmers

Secondary Data Collection

- Books and Journals
- Relevant websites

5.4 Observation schedule

Both the species are diurnal and actively forage during the day time, hence the time schedule of observations will be from sunrise to sunset. Observations will be taken and empirical data will be collected for 2 consecutive years in the following seasons:

- Summer (April-June)
- Monsoon (July-September)
- Autumn (Oct-Nov)
- Winter (Dec-Jan)
- Spring (Feb-March)

5.5 Tools and equipment

- Canon PowerShot with 25X zoom for still photography and videography
- Binoculars
- Stopwatch
- Notepad
- Behavior coding software (Observer^{XT} by Noldus Technologies)
- Garmin GPS tracking device and GIS software
- MS-Excel
- Factor Analysis statistical tool

5.6 Targeted behaviors

- Locomotion during foraging
- Communication during foraging
- Vigilance during foraging
- Action patterns during foraging
- Intra-specific interactions during foraging- aggression, conflict, co-operation
- Inter-specific interactions during foraging- aggression, conflict, co-operation with species like mynas and squirrels which are their feeding associates

6. DATA INTERPRETATION

6.1 Manual observations

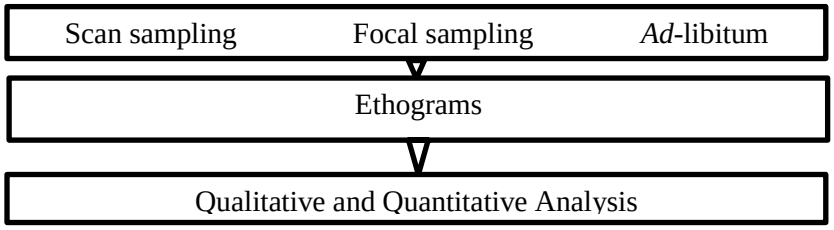

Figure 9 : Flowchart depicting analysis through Manual observations

6.2 Video clippings

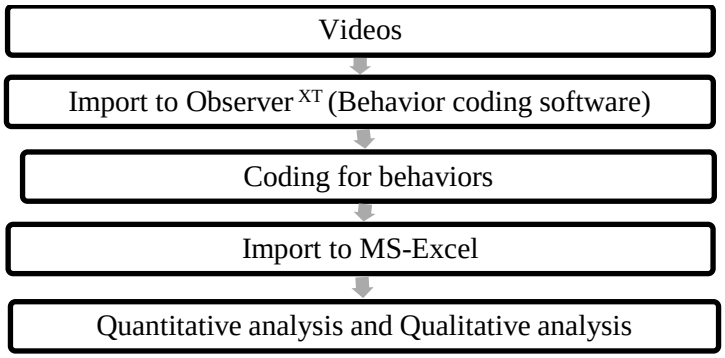

Figure 10 : Flowchart depicting analysis through Video clippings

7. PLAN OF WORK

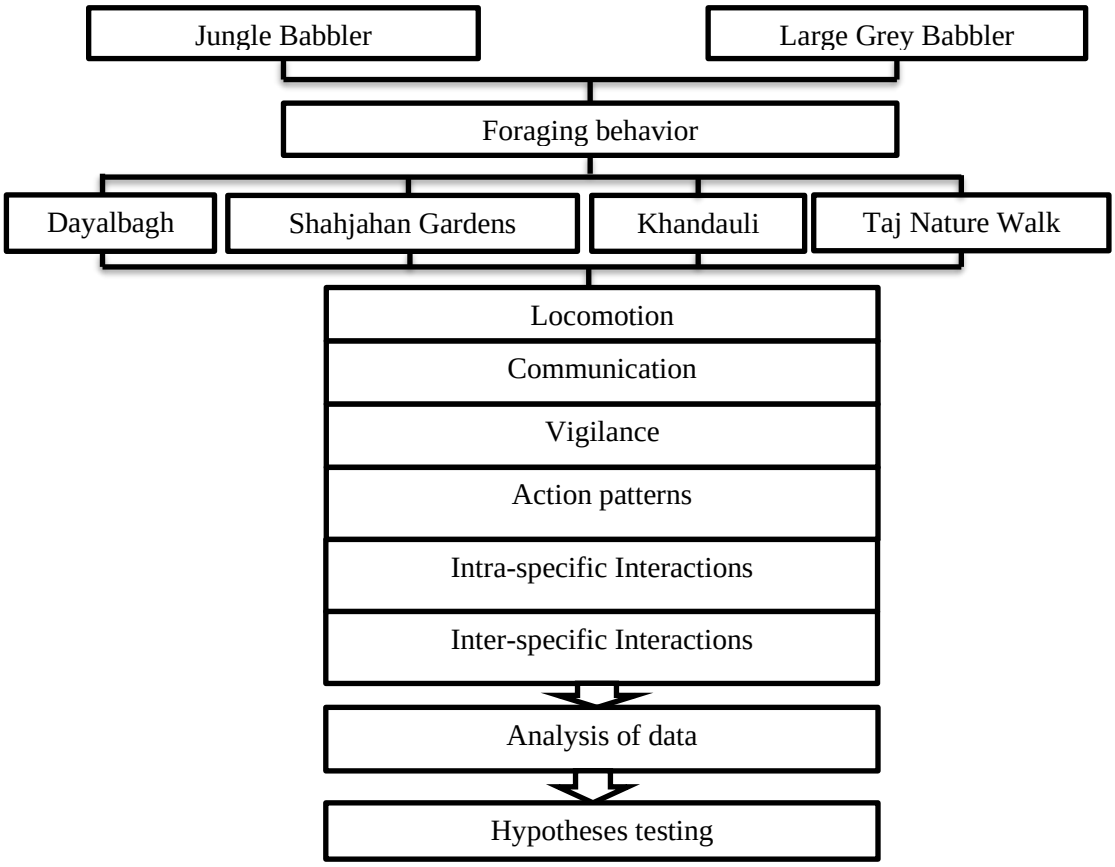

Figure 11 : Schematic representation of the Plan of Work

8. REFERENCES

1. Ali, S. and Ripley, S.D. (1995). The Pictorial Guide to the Birds of Indian Sub-continent. *Oxford University Press and BNHS, Mumbai,* 2nd Edition(updated)
2. Altmann, J. (1974). Observational study of behavior: sampling methods. *Behaviour*, 49(3-4): 227-266.
3. Anthal, A. & Sahi, D. N. (2013). Food and Feeding Ecology of Jungle Babbler, *Turdoides striatus sindianus* (Ticehurst) in District Jammu (J&K), India. *International Research Journal of Environment Sciences*, 2(7): 54-57.
4. Bharucha, B. & Padate, G. S. (2010). Assessment of beneficial role of an insectivorous bird, Jungle Babbler (*Turdoides striatus*) predation, on *Helicoverpa armigera* infesting pigeon pea (*Cajanus cajan*) crop. *Acta Agronomica*, *59*(2): 228-235.
5. BirdLife International (2016). *Argya malcolmi*. *The IUCN Red List of Threatened Species* 2016: e.T22716361A94492467.
6. BirdLife International (2016). *Turdoides striata*. *The IUCN Red List of Threatened Species* 2016: e.T103871402A94493697.
7. Cai, T., Cibois, A., Alstrom, P., Moyle, R.G., Kennedy, J.D., Shao, S., Zhang, R., Irestedt, M., Ericson, P.G.P., Gelang, M., Qu, Y., Lei, F. & Fjeldsa, J. (2018). Near-complete phylogeny and taxonomic revision of the world's babblers (Aves: Passeriformes), *Molecular Phylogenetics and Evolution*, Accepted manuscript, D.O.A - 09.10.2018
8. Cibois, A., Gelang, M., Alstrom, P., Pasquet, E., Fjeldsa, J., Ericson, P.G.P. & Olsson, U. (2018). Comprehensive phylogeny of the laughing thrushes and allies (Aves, Leiothrichidae) and a proposal for a revised taxonomy. *Zoologica Scripta*, 47:428–440.
9. del Hoyo, J., Elliott, A. & Christie, D. (2007). Handbook of the Birds of the World. Picathartes to Tits and Chickadees. *Lynx Edicions,* Barcelona, 12th edition.
10. Gaston, A. J. (1977). Social behaviour within groups of Jungle Babblers (*Turdoides striatus*). *Animal Behaviour, 25*: 828-848.
11. Gaston, A. J. (1978). Demography of the Jungle Babbler, *Turdoides striatus*. *The Journal of Animal Ecology*: 845-870.

12. Gaston, A. J., Mathew, D. N. & Zacharias, V. J. (1979). Regional variation in the breeding seasons of babblers (*Turdoides* spp.) in India. *Ibis*, *121*(4): 512-516.
13. Gill, F. & Donsker, D. (2018) IOC World Bird List (version 8.1)
14. Gupta, N. & Talukdar, G. (2018). A Babbler's tale: assessing the distribution of *Turdoides striata* (Dumont, 1823) (Aves: Passeriformes: Leiothrichidae) in India. *Journal of Threatened Taxa*, *10*(3):11450-11453.
15. Gupta, N. (2014). Group size in Jungle Babblers: revisiting the "seven sisters" theory. *International Journal of Innovative Science, Engineering & Technology,* 1(5)
16. Keynan, O., Ridley, A. R., & Lotem, A. (2015). Social foraging strategies and acquisition of novel foraging skills in cooperatively breeding Arabian babblers. *Behavioral ecology*, *26*(1): 207-214.
17. Mansor, M. S. & Ramli, R. (2017). Foraging niche segregation in Malaysian babblers (Family: Timaliidae). *PloS one*, *12*(3).
18. Martin, P. & Bateson, P. (1993). Measuring Behavior: An Introductory Guide, 2nd edition. *Cambridge University Press*, New York: 90-91.
19. Peterson, A. T., Soberon, J. & Sanchez-Cordero, V. (1999). Conservatism of ecological niches in evolutionary time. *Science*, *285*(5431): 1265-1267.
20. Remsen Jr, J. V. & Robinson, S. K. (1990). A classification scheme for foraging behavior of birds in terrestrial habitats. *Studies in Avian Biology*, *13*: 144-160.
21. Sorato, E., Gullett, P. R., Griffith, S. C. & Russell, A. F. (2012). Effects of predation risk on foraging behaviour and group size: adaptations in a social cooperative species. *Animal Behaviour*, *84*(4): 823-834.
22. Srivastava, M. (2013). Breeding behavior of Babbler *Turdoides striata* as observed in a house courtyard in Bikaner, Rajasthan (India). *Poultry, Fisheries & Wildlife Science*, 1:104.
23. Styring, A. R., Ragai, R., Zakaria, M. & Sheldon, F. H. (2016). Foraging ecology and occurrence of 7 sympatric babbler species (Timaliidae) in the lowland rainforest of Borneo and peninsular Malaysia. *Current Zoology*, *62*(4): 345-355.
24. Toor, H. S. & Saini, M. S. (1986). Feeding ecology of the Large Grey Babbler *Turdoides malcolmi*. *Proceedings: Animal Sciences*, *95*(4): 429-436.

25. Yambem, S. D., Chorol, S., & Jain, M. (2020). Structural and functional complexity of vocalizations in a cooperatively breeding passerine, Jungle Babbler. *bioRxiv*.